

PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION OF ELECTION
(PCT Rule 61.2)

To:

Assistant Commissioner for Patents
 United States Patent and Trademark
 Office
 Box PCT
 Washington, D.C.20231
 ÉTATS-UNIS D'AMÉRIQUE

in its capacity as elected Office

| | |
|---|---|
| Date of mailing (day/month/year) 07 March 2000 (07.03.00) | |
| International application No. PCT/US99/12121 | Applicant's or agent's file reference F8172-9023 |
| International filing date (day/month/year) 02 June 1999 (02.06.99) | Priority date (day/month/year) 02 June 1998 (02.06.98) |
| Applicant CUNNINGHAM, Francis, X., Jr. et al | |

1. The designated Office is hereby notified of its election made:

in the demand filed with the International Preliminary Examining Authority on:
30 December 1999 (30.12.99)

in a notice effecting later election filed with the International Bureau on:

2. The election was

was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

| | |
|---|--|
| The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No.: (41-22) 740.14.35 | Authorized officer Claudio Borton Telephone No.: (41-22) 338.83.38 |
|---|--|

PATENT COOPERATION TREATY

PCT

INFORMATION CONCERNING ELECTED
OFFICES NOTIFIED OF THEIR ELECTION

(PCT Rule 61.3)

Date of mailing (day/month/year)
07 March 2000 (07.03.00)

From the INTERNATIONAL BUREAU

To:

GOLDHUSH, Douglas, H.
Nikaido, Marmelstein, Murray &
Oram LLP
Suite 330 - G Street Lobby
Metropolitan Square
655 Fifteenth Street, N.W.
Washington, DC 20005-5701
ÉTATS-UNIS D'AMÉRIQUE

Applicant's or agent's file reference
F8172-9023

IMPORTANT INFORMATION

International application No.
PCT/US99/12121

International filing date (day/month/year)
02 June 1999 (02.06.99)

Priority date (day/month/year)
02 June 1998 (02.06.98)

Applicant
UNIVERSITY OF MARYLAND et al

1. The applicant is hereby informed that the International Bureau has, according to Article 31(7), notified each of the following Offices of its election:

AP :GH,GM,KE,LS,MW,SD,SL,SZ,UG,ZW

EP :AT,BE,CH,CY,DE,DK,ES,FI,FR,GB,GR,IE,IT,LU,MC,NL,PT,SE

National :AU,BG,BR,CA,CN,CZ,DE,IL,JP,KP,KR,MN,NO,NZ,PL,RO,RU,SE,SK,US

2. The following Offices have waived the requirement for the notification of their election; the notification will be sent to them by the International Bureau only upon their request:

EA :AM,AZ,BY,KG,KZ,MD,RU,TJ,TM

OA :BF,BJ,CF,CG,CI,CM,GA,GN,GW,ML,MR,NE,SN,TD,TG

National :AE,AL,AM,AT,AZ,BA,BB,BY,CH,CU,DK,EE,ES,FI,GB,GD,GE,GH,GM,HR,HU,
ID,IN,IS,KE,KG,KZ,LC,LR,LS,LT,LU,LV,MD,MG,MK,MW,MX,PT,SD,SG,SI,SL,TJ,
TM,TR,TT,UA,UG,UZ,VN,YU,ZA,ZW

3. The applicant is reminded that he must enter the "national phase" before the expiration of 30 months from the priority date before each of the Offices listed above. This must be done by paying the national fee(s) and furnishing, if prescribed, a translation of the international application (Article 39(1)(a)), as well as, where applicable, by furnishing a translation of any annexes of the international preliminary examination report (Article 36(3)(b) and Rule 74.1).

Some offices have fixed time limits expiring later than the above-mentioned time limit. For detailed information about the applicable time limits and the acts to be performed upon entry into the national phase before a particular Office, see Volume II of the PCT Applicant's Guide.

The entry into the European regional phase is postponed until 31 months from the priority date for all States designated for the purposes of obtaining a European patent.

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland

Authorized officer:

Claudio Borton

Telephone No. (41-22) 338.83.38

Facsimile No. (41-22) 740.14.35

PATENT COOPERATION TREATY

From the
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

To: DOUGLAS H. GOLDHUSH
NIKAIKO, MARMELSTEIN, MURRAY & ORAM, LLP
METROPOLITAN SQUARE
655 FIFTEENTH STREET, N.W.
SUITE 330 - G STREET LOBBY
WASHINGTON, DC 20005-5701

PCT

WRITTEN OPINION

(PCT Rule 66)

Date of Mailing
(day/month/year)

14 APR 2000

| | | |
|---|--|--|
| Applicant's or agent's file reference F8172-9023 | | REPLY DUE within TWO months from the above date of mailing |
| International application No. PCT/US99/12121 | International filing date (day/month/year) 02 JUNE 1999 | Priority date (day/month/year) 02 JUNE 1998 |
| International Patent Classification (IPC) or both national classification and IPC Please See Supplemental Sheet. | | |
| Applicant UNIVERSITY OF MARYLAND | | |

1. This written opinion is the first _____ (first, etc.) drawn by this International Preliminary Examining Authority.

2. This opinion contains indications relating to the following items:

- I Basis of the opinion
- II Priority
- III Non-establishment of opinion with regard to novelty, inventive step or industrial applicability
- IV Lack of unity of invention
- V Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI Certain documents cited
- VII Certain defects in the international application
- VIII Certain observations on the international application

3. The applicant is hereby invited to reply to this opinion.

When? See the time limit indicated above. The applicant may, before the expiration of that time limit, request this Authority to grant an extension, see Rule 66.2(d).

How? By submitting a written reply, accompanied, where appropriate, by amendments, according to Rule 66.3. For the form and the language of the amendments, see Rules 66.8 and 66.9.

Also For an additional opportunity to submit amendments, see Rule 66.4.
For the examiner's obligation to consider amendments and/or arguments, see Rule 66.4 bis.
For an informal communication with the examiner, see Rule 66.6.

If no reply is filed, the international preliminary examination report will be established on the basis of this opinion.

4. The final date by which the international preliminary examination report must be established according to Rule 69.2 is: 02 OCTOBER 2000

Name and mailing address of the IPEA/US
Commissioner of Patents and Trademarks
Box PCT
Washington, D.C. 20231

Facsimile No. (703) 305-3230

Authorized officer

BRADLEY S. MAYHEW

Telephone No. (703) 308-0196

WRITTEN OPINION

International application No.

PCT/US99/12121

I. Basis of the opinion

1. With regard to the elements of the international application:^{*} the international application as originally filed the description:

pages 1-26 _____, as originally filed
 pages NONE _____, filed with the demand
 pages NONE _____, filed with the letter of _____

 the claims:

pages NONE _____, as originally filed
 pages NONE _____, as amended (together with any statement) under Article 19
 pages 27 _____, filed with the demand
 pages NONE _____, filed with the letter of _____

 the drawings:

pages 1-45 _____, as originally filed
 pages NONE _____, filed with the demand
 pages NONE _____, filed with the letter of _____

 the sequence listing part of the description:

pages 1-72 _____, as originally filed
 pages NONE _____, filed with the demand
 pages NONE _____, filed with the letter of _____

2. With regard to the language, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.
These elements were available or furnished to this Authority in the following language _____ which is: the language of a translation furnished for the purposes of international search (under Rule 23.1(b)). the language of publication of the international application (under Rule 48.3(b)). the language of the translation furnished for the purposes of international preliminary examination (under Rules 55.2 and/or 55.3).

3. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the written opinion was drawn on the basis of the sequence listing:

 contained in the international application in printed form. filed together with the international application in computer readable form. furnished subsequently to this Authority in written form. furnished subsequently to this Authority in computer readable form. The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished. The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.4. The amendments have resulted in the cancellation of: the description, pages NONE the claims, Nos. NONE the drawings, sheets Fig. NONE5. This opinion has been drawn as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

* Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this opinion as "originally filed".

WRITTEN OPINION

| |
|-------------------------------|
| International application No. |
| PCT/US99/12121 |

V. Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**1. statement**

| | | |
|-------------------------------|--------------------|-----|
| Novelty (N) | Claims <u>NONE</u> | YES |
| | Claims <u>1-8</u> | NO |
| Inventive Step (IS) | Claims <u>NONE</u> | YES |
| | Claims <u>1-8</u> | NO |
| Industrial Applicability (IA) | Claims <u>1-8</u> | YES |
| | Claims <u>NONE</u> | NO |

2. citations and explanations

Claims 1-5 and 7-8 lack novelty under PCT Article 33(2) as being anticipated by the University of Maryland College Park (WO 97/36998). SEQ ID No:1 of the reference discloses a polynucleotide that meets the limitations of claims 1 and 2 of the instant application. The reference at pages 18-19 describe the construction of vectors comprising such polynucleotides, thereby anticipating claims 2-3. The reference at pages 22-23 describe the construction of bacterial host cells comprising such vectors, thereby anticipating claims 4-5. SEQ ID No:2 of the reference discloses a polypeptide that meets the limitations of claims 7 and 8 of the instant application.

Claim 6 lacks an inventive step under PCT Article 33(3) as being obvious over University of Maryland College Park (WO 97/36998). As indicated above, SEQ ID No:1 of the reference discloses a polynucleotide that meets the limitations of claims 1 and 2 of the instant application, and vectors comprising them. The reference does not teach an actual example of photosynthetic host cell comprising such vectors. However, the reference at pages 15-16 provides ample motivation for constructing such a host cell and a reasonable expectation for successfully doing so. Therefore, the claimed invention is obvious over the cited reference.

----- NEW CITATIONS -----
NONE

WRITTEN OPINION

International application No.

PCT/US99/12121

Supplemental Box

(To be used when the space in any of the preceding boxes is not sufficient)

Continuation of: Boxes I - VIII

Sheet 10

TIME LIMIT:

The time limit set for response to a Written Opinion may not be extended. 37 CFR 1.484(d). Any response received after the expiration of the time limit set in the Written Opinion will not be considered in preparing the International Preliminary Examination Report.

CLASSIFICATION:

The International Patent Classification (IPC) and/or the National classification are as listed below:
IPC(7): C12N 1/21, 5/10, 9/10, 15/53, 15/54, 15/61, 15/63; C12P 23/00; C12Q 1/68 and US Cl.: 435/189, 193, 233, 252.3, 320.1, 325; 536/23.2

PATENT COOPERATION TREATY

PCT

NOTICE INFORMING THE APPLICANT OF THE COMMUNICATION OF THE INTERNATIONAL APPLICATION TO THE DESIGNATED OFFICES

(PCT Rule 47.1(c), first sentence)

From the INTERNATIONAL BUREAU

To:

GOLDHUSH, Douglas, H.
Nikaido, Marmelstein, Murray &
Oram LLP
Suite 330 - G Street Lobby
Metropolitan Square
655 Fifteenth Street, N.W.
Washington, DC 20005-5701
ÉTATS-UNIS D'AMÉRIQUE

| | | |
|---|---|---|
| Date of mailing (day/month/year) 09 December 1999 (09.12.99) | | |
| Applicant's or agent's file reference F8172-9023 | | |
| International application No. PCT/US99/12121 | International filing date (day/month/year) 02 June 1999 (02.06.99) | Priority date (day/month/year) 02 June 1998 (02.06.98) |
| Applicant UNIVERSITY OF MARYLAND et al | | |

IMPORTANT NOTICE

- Notice is hereby given that the International Bureau has communicated, as provided in Article 20, the international application to the following designated Offices on the date indicated above as the date of mailing of this Notice:
AU,CN,EP,IL,JP,KP,KR,US

In accordance with Rule 47.1(c), third sentence, those Offices will accept the present Notice as conclusive evidence that the communication of the international application has duly taken place on the date of mailing indicated above and no copy of the international application is required to be furnished by the applicant to the designated Office(s).

- The following designated Offices have waived the requirement for such a communication at this time:

**AE,AL,AM,AP,AT,AZ,BA,BB,BG,BR,BY,CA,CH,CU,CZ,DE,DK,EA,EE,ES,FI,GB,GD,GE,GH,GM,HR,
HU,IN,IS,KE,KG,KZ,LC,LK,LR,LS,LT,LU,LV,MD,MG,MK,MN,MW,MX,NO,NZ,OA,PL,PT,RO,RU,
SD,SE,SG,SI,SK,SL,TJ,TM,TR,TT,UA,UG,UZ,VN,YU,ZA,ZW**

The communication will be made to those Offices only upon their request. Furthermore, those Offices do not require the applicant to furnish a copy of the international application (Rule 49.1(a-bis)).

- Enclosed with this Notice is a copy of the international application as published by the International Bureau on 09 December 1999 (09.12.99) under No. WO 99/63055

REMINDER REGARDING CHAPTER II (Article 31(2)(a) and Rule 54.2)

If the applicant wishes to postpone entry into the national phase until 30 months (or later in some Offices) from the priority date, a **demand for international preliminary examination** must be filed with the competent International Preliminary Examining Authority before the expiration of 19 months from the priority date.

It is the applicant's sole responsibility to monitor the 19-month time limit.

Note that only an applicant who is a national or resident of a PCT Contracting State which is bound by Chapter II has the right to file a demand for international preliminary examination.

REMINDER REGARDING ENTRY INTO THE NATIONAL PHASE (Article 22 or 39(1))

If the applicant wishes to proceed with the international application in the **national phase**, he must, within 20 months or 30 months, or later in some Offices, perform the acts referred to therein before each designated or elected Office.

For further important information on the time limits and acts to be performed for entering the national phase, see the Annex to Form PCT/IB/301 (Notification of Receipt of Record Copy) and Volume II of the PCT Applicant's Guide.

| | |
|---|---------------------------------|
| The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland | Authorized officer J. Zahra |
| Facsimile No. (41-22) 740.14.35 | Telephone No. (41-22) 338.83.38 |

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US99/12121

A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) :Please See Extra Sheet.

US CL :435/189, 193, 233, 252.3, 320.1, 325; 536/23.2

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 435/189, 193, 233, 252.3, 320.1, 325; 536/23.2

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

Please See Extra Sheet.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|-----------|--|-----------------------|
| X | WO 97/36998 A1 (UNIVERSITY OF MARYLAND COLLEGE PARK) 09 October 1997, see entire document, especially SEQ ID No:1. | 1-8 |

Further documents are listed in the continuation of Box C. See patent family annex.

| | | |
|---|-----|--|
| Special categories of cited documents: | "T" | later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention |
| "A" document defining the general state of the art which is not considered to be of particular relevance | "X" | document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone |
| "E" earlier document published on or after the international filing date | "Y" | document of particular relevance, the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art |
| "L" document which may throw doubt on priority claims(s) or which is cited to establish the publication date of another citation or other special reason (as specified) | "Z" | document member of the same patent family |
| "D" document referring to an oral disclosure, use, exhibition or other means | | |
| "P" document published prior to the international filing date but later than the priority date claimed | | |

Date of the actual completion of the international search

02 AUGUST 1999

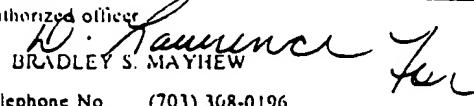
Date of mailing of the international search report

15 SEP 1999

Name and mailing address of the ISA US
Commissioner of Patents and TrademarksBox PCT
Washington, D.C. 20231

Facsimile No (703) 305-3230

Authorized officer



Telephone No. (703) 308-0196

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US99/12121

A. CLASSIFICATION OF SUBJECT MATTER:

IPC (6):

C12N 1/21, 5/10, 9/10, 15/53, 15/54, 15/61, 15/63; C12P 23/00; C12Q 1/68

B. FIELDS SEARCHED

Electronic data bases consulted (Name of data base and where practicable terms used):

Dialog and APS

search terms: IPP, epsilon cyclase, lycopene cyclase, isopentenyl pyrophosphate isomerase and isopentenyl diphosphate isomerase

PATENT COOPERATION TREATY

PCTREC'D 03 NOV 2000
15

WIPO PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

| | | |
|--|---|---|
| Applicant's or agent's file reference F8172-9023 | FOR FURTHER ACTION | See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416) |
| International application No. PCT/US99/12121 | International filing date (day/month/year) 02 JUNE 1999 | Priority date (day/month/year) 02 JUNE 1998 |
| International Patent Classification (IPC) or national classification and IPC Please See Supplemental Sheet. | | |
| Applicant UNIVERSITY OF MARYLAND | | |

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 4 sheets.

This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority. (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 0 sheets.

3. This report contains indications relating to the following items:

- I Basis of the report
- II Priority
- III Non-establishment of report with regard to novelty, inventive step or industrial applicability
- IV Lack of unity of invention
- V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI Certain documents cited
- VII Certain defects in the international application
- VIII Certain observations on the international application

**CORRECTED
VERSION**

| | |
|--|--|
| Date of submission of the demand 30 DECEMBER 1999 | Date of completion of this report 02 AUGUST 2000 |
| Name and mailing address of the IPEA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 | Authorized officer <i>my Meas</i> Peter Tung |
| Facsimile No. (703) 305-3230 | Telephone No. (703) 308-0196 |

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/US99/12121

I. Basis of the report

1. With regard to the elements of the international application:^{*} the international application as originally filed the description:

pages 1-26

pages NONE

pages NONE

, filed with the letter of _____

 the claims:

pages 27

pages NONE , as amended (together with any statement) under Article 19

pages NONE

, filed with the demand

pages NONE

, filed with the letter of _____

 the drawings:

pages 1-45

pages NONE

pages NONE

, filed with the letter of _____

 the sequence listing part of the description:

pages 1-72

pages NONE , as originally filed

pages NONE

, filed with the letter of _____

2. With regard to the language, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.
These elements were available or furnished to this Authority in the following language _____ which is: the language of a translation furnished for the purposes of international search (under Rule 23.1(b)). the language of publication of the international application (under Rule 48.3(b)). the language of the translation furnished for the purposes of international preliminary examination (under Rules 55.2 and/or 55.3).

3. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

 contained in the international application in printed form. filed together with the international application in computer readable form. furnished subsequently to this Authority in written form. furnished subsequently to this Authority in computer readable form. The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished. The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.4. The amendments have resulted in the cancellation of: the description, pages NONE the claims, Nos. NONE the drawings, sheets/fig NONE5. This report has been drawn as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).^{**}^{*} Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).^{**} Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/US99/12121

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**1. statement****Novelty (N)**

Claims 1-8 YES
Claims NONE NO

Inventive Step (IS)

Claims 1-8 YES
Claims NONE NO

Industrial Applicability (IA)

Claims 1-8 YES
Claims NONE NO

2. citations and explanations (Rule 70.7)

Applicants argue that claims 1-5, 7 and 8 are not anticipated by WO 97/36998. The amino acid taught by WO 97/36998 is not at least 85% identical to SEQ ID NOS: 23, 25 and 26.

Applicants arguments are sufficient to overcome the lack of novelty of the instant claims based upon the prior art of record.

Claim 1-8 the criteria set out in PCT Article 33(2)-(4), because the prior art of record does not teach or fairly suggest SEQ ID NO: 23, 25 and 26.

----- NEW CITATIONS -----

NONE

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/US99/12121

Suppl mental Box

(To be used when the space in any of the preceding boxes is not sufficient)

Continuation of: Boxes I - VIII

Sheet 10

CLASSIFICATION:

The International Patent Classification (IPC) and/or the National classification are as listed below:

IPC(7): C12N 1/21, 5/10, 9/10, 15/53, 15/54, 15/61, 15/63; C12P 23/00; C12Q 1/68 and US Cl.: 435/189, 193, 233, 252.3, 320.1, 325; 536/23.2

PATENT COOPERATION TREATY

From the
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

To: DOUGLAS H. GOLDHUSH
NIKAIKO, MARMELSTEIN, MURRAY & ORAM, LLP
METROPOLITAN SQUARE
655 FIFTEENTH STREET, N.W.
SUITE 330 - G STREET LOBBY
WASHINGTON, DC 20005-5701

PCT

NOTIFICATION OF TRANSMITTAL OF INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Rule 71.1)

| | | |
|---|--|--|
| | | Date of Mailing (day/month/year) 31 OCT 2000 |
| Applicant's or agent's file reference F8172-9023 | | IMPORTANT NOTIFICATION |
| International application No. PCT/US99/12121 | International filing date (day/month/year) 02 JUNE 1999 | Priority Date (day/month/year) 02 JUNE 1998 |
| Applicant UNIVERSITY OF MARYLAND | | |

1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary examination report and its annexes, if any, established on the international application.
2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.
3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.
4. **REMINDER**

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices)(Article 39(1))(see also the reminder sent by the International Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary examination report. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the PCT Applicant's Guide.

| | |
|--|--|
| Name and mailing address of the IPEA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703) 305-3230 | Authorized officer Peter Tung <i>mymlas</i> Telephone No. (703) 308-0196 |
|--|--|

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

| | | |
|--|--|---|
| Applicant's or agent's file reference F8172-9023 | FOR FURTHER ACTION | See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416) |
| International application No. PCT/US99/12121 | International filing date (day/month/year) 02 JUNE 1999 | Priority date (day/month/year) 02 JUNE 1998 |
| International Patent Classification (IPC) or national classification and IPC Please See Supplemental Sheet. | | |
| Applicant UNIVERSITY OF MARYLAND | | |

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 4 sheets.

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These annexes consist of a total of 0 sheets.

3. This report contains indications relating to the following items:

- I Basis of the report
- II Priority
- III Non-establishment of report with regard to novelty, inventive step or industrial applicability
- IV Lack of unity of invention
- V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI Certain documents cited
- VII Certain defects in the international application
- VIII Certain observations on the international application

| | |
|--|---|
| Date of submission of the demand 30 DECEMBER 1999 | Date of completion of this report 02 AUGUST 2000 |
| Name and mailing address of the IPEA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 | Authorized officer <i>Peter Tung my Meas</i> |
| Facsimile No. (703) 305-3230 | Telephone No. (703) 308-0196 |

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/US99/12121

L Basis of the report1. With regard to the elements of the international application:^{*} the international application as originally filed the description:pages 1-26 _____, as originally filed
pages NONE _____, filed with the demand
pages NONE _____, filed with the letter of _____ the claims:pages 27 _____, as originally filed
pages NONE _____, as amended (together with any statement) under Article 19
pages NONE _____, filed with the demand
pages NONE _____, filed with the letter of _____ the drawings:pages 1-45 _____, as originally filed
pages NONE _____, filed with the demand
pages NONE _____, filed with the letter of _____ the sequence listing part of the description:pages 1-72 _____, as originally filed
pages NONE _____, filed with the demand
pages NONE _____, filed with the letter of _____2. With regard to the language, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.
These elements were available or furnished to this Authority in the following language _____ which is: the language of a translation furnished for the purposes of international search (under Rule 23.1(b)). the language of publication of the international application (under Rule 48.3(b)). the language of the translation furnished for the purposes of international preliminary examination (under Rules 55.2 and/or 55.3).

3. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

 contained in the international application in printed form. filed together with the international application in computer readable form. furnished subsequently to this Authority in written form. furnished subsequently to this Authority in computer readable form. The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished. The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.4. The amendments have resulted in the cancellation of: the description, pages NONE the claims, Nos. NONE the drawings, sheets/fig NONE5. This report has been drawn as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).^{**}^{*} Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).^{**} Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/US99/12121

V. Reasons statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**1. statement**

| | | |
|-------------------------------|--------------------|-----|
| Novelty (N) | Claims <u>1-8</u> | YES |
| | Claims <u>NONE</u> | NO |
| Inventive Step (IS) | Claims <u>1-8</u> | YES |
| | Claims <u>NONE</u> | NO |
| Industrial Applicability (IA) | Claims <u>1-8</u> | YES |
| | Claims <u>NONE</u> | NO |

2. citations and explanations (Rule 70.7)

Applicants argue that claims 1-5, 7 and 8 are not anticipated by WO 97/36998. The amino acid taught by WO 97/36998 is not at least 85% identical to SEQ ID NOs: 23, 25 and 26.

Applicants arguments are sufficient to overcome the lack of novelty of the instant claims based upon the prior art of record.

Claim 1-8 the criteria set out in PCT Article 33(2)-(4), because the prior art of record does not teach or fairly suggest SEQ ID NO: 23, 25 and 26.

————— NEW CITATIONS —————
NONE

Supplemental Box

(To be used when the space in any of the preceding boxes is not sufficient)

Continuation of: Boxes I - VIII

Sheet 10

CLASSIFICATION:

The International Patent Classification (IPC) and/or the National classification are as listed below:

IPC(7): C12N 1/21, 5/10, 9/10, 15/53, 15/54, 15/61, 15/63; C12P 23/00; C12Q 1/68 and US Cl.: 435/189, 193, 233, 252.3, 320.1, 325; 536/23.2

PATENT COOPERATION TREATY

From the
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

To: DOUGLAS H. GOLDHUSH
NIKAIKO, MARMELSTEIN, MURRAY & ORAM,
LLP
METROPOLITAN SQUARE
655 FIFTEENTH STREET, N.W.
SUITE 330 - G STREET LOBBY
WASHINGTON, DC 20005-5701

PCT

NOTIFICATION OF TRANSMITTAL OF INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Rule 71.1)

24 AUG 2000

| | | |
|---|--|--|
| Applicant's or agent's file reference F8172-9023 | IMPORTANT NOTIFICATION | |
| International application No. PCT/US99/12121 | International filing date (day/month/year) 02 JUNE 1999 | Priority Date (day/month/year) 02 JUNE 1998 |
| Applicant UNIVERSITY OF MARYLAND | | |

1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary examination report and its annexes, if any, established on the international application.
2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.
3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.
4. **REMINDER**

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices)(Article 39(1))(see also the reminder sent by the International Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary examination report. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the PCT Applicant's Guide.

| | |
|--|---|
| Name and mailing address of the IPEA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703) 305-3230 | Authorized officer BRADLEY S. MAYHEW Telephone No. (703) 308-0196 |
|--|---|

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

| | | |
|--|---|--|
| Applicant's or agent's file reference F8172-9023 | FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416) | |
| International application No. PCT/US99/12121 | International filing date (day/month/year) 02 JUNE 1999 | Priority date (day/month/year) 02 JUNE 1998 |
| International Patent Classification (IPC) or national classification and IPC Please See Supplemental Sheet. | | |
| Applicant UNIVERSITY OF MARYLAND | | |

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 4 sheets.

This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority. (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 1 sheets.

3. This report contains indications relating to the following items:

- I Basis of the report
- II Priority
- III Non-establishment of report with regard to novelty, inventive step or industrial applicability
- IV Lack of unity of invention
- V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI Certain documents cited
- VII Certain defects in the international application
- VIII Certain observations on the international application

| | |
|--|--|
| Date of submission of the demand 30 DECEMBER 1999 | Date of completion of this report 02 AUGUST 2000 |
| Name and mailing address of the IPEA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703) 305-3230 | Authorized officer BRADLEY S. MAYHEW Telephone No. (703) 308-0196  |

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/US99/12121

I. Basis of the report

1. With regard to the elements of the international application:*

 the international application as originally filed the description:

pages 1-26, as originally filed

pages NONE

pages NONE, filed with the demand

 the claims:

pages NONE, as originally filed

pages NONE, as amended (together with any statement) under Article 19

pages 27, filed with the demand

pages NONE, filed with the letter of _____

 the drawings:

pages 1-45, as originally filed

pages NONE, filed with the demand

pages NONE, filed with the letter of _____

 the sequence listing part of the description:

pages 1-72, as originally filed

pages NONE, filed with the demand

pages NONE, filed with the letter of _____

2. With regard to the language, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.
These elements were available or furnished to this Authority in the following language _____ which is: the language of a translation furnished for the purposes of international search (under Rule 23.1(b)). the language of publication of the international application (under Rule 48.3(b)). the language of the translation furnished for the purposes of international preliminary examination (under Rules 55.2 and/or 55.3).

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INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/US99/12121

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**1. statement**

| | | |
|-------------------------------|--------------------|-----|
| Novelty (N) | Claims <u>NONE</u> | YES |
| | Claims <u>1-8</u> | NO |
| Inventive Step (IS) | Claims <u>NONE</u> | YES |
| | Claims <u>1-8</u> | NO |
| Industrial Applicability (IA) | Claims <u>1-8</u> | YES |
| | Claims <u>NONE</u> | NO |

2. citations and explanations (Rule 70.7)

Claims 1-5 and 7-8 lack novelty under PCT Article 33(2) as being anticipated by the University of Maryland College Park (WO 97/36998). SEQ ID No:1 of the reference discloses a polynucleotide that meets the limitations of claims 1 and 2 of the instant application. The reference at pages 18-19 describe the construction of vectors comprising such polynucleotides, thereby anticipating claims 2-3. The reference at pages 22-23 describe the construction of bacterial host cells comprising such vectors, thereby anticipating claims 4-5. SEQ ID No:2 of the reference discloses a polypeptide that meets the limitations of claims 7 and 8 of the instant application.

Claim 6 lacks an inventive step under PCT Article 33(3) as being obvious over University of Maryland College Park (WO 97/36998). As indicated above, SEQ ID No:1 of the reference discloses a polynucleotide that meets the limitations of claims 1 and 2 of the instant application, and vectors comprising them. The reference does not teach an actual example of photosynthetic host cell comprising such vectors. However, the reference at pages 15-16 provides ample motivation for constructing such a host cell and a reasonable expectation for successfully doing so. Therefore, the claimed invention is obvious over the cited reference.

----- NEW CITATIONS -----
NONE

Supplemental Box

(To be used when the space in any of the preceding boxes is not sufficient)

Continuation of: Boxes I - VIII

Sheet 10

CLASSIFICATION:

The International Patent Classification (IPC) and/or the National classification are as listed below:

IPC(7): C12N 1/21, 5/10, 9/10, 15/53, 15/54, 15/61, 15/63; C12P 23/00; C12Q 1/68 and US Cl.: 435/189, 193, 233, 252.3, 320.1, 325; 536/23.2

OCT/US 99/1212
IPEA/US 20 DEC 1999
COP

We claim:

1. An isolated and/or purified nucleic acid sequence which encodes for a protein having lycopene ϵ -cyclase enzyme activity and has an amino acid sequence which is at least 85% identical to one of SEQ ID NOS: 23, 25 or 26.
- 5 2. The nucleic acid sequence of claim 1, wherein the protein has the amino acid sequence of one of SEQ ID NOS: 23, 25 or 26.
3. A vector comprising the nucleic acid sequence of claim 1, wherein the nucleic acid sequence is operably linked to a promoter.
4. A host cell which contains the vector of claim 3.
- 10 5. The host cell of claim 4, wherein the host cell is selected from the group consisting of a bacterial cell, an algal cell, a yeast cell and a plant cell.
6. The host cell of claim 4, wherein the host cell is a photosynthetic cell.
7. An isolated and/or purified protein having lycopene ϵ -cyclase enzyme activity and having an amino acid sequence which is at least 85% identical to one of SEQ ID NOS: 23, 25
15 or 26.
8. The protein of claim 7, wherein the protein has the amino acid sequence of one of SEQ ID NOS: 23, 25 or 26.